IMMATURE STAGES AND BIOLOGY OF *ORIUS TANTILLUS* (MOTSCHULSKY), (HEMIPTERA: ANTHOCORIDAE), INHABITING RICE FIELDS IN WEST MALAYSIA[1]

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ABSTRACT: Results of a study of the predatory anthocorid bug, *Orius tantillus* (Motschulsky), collected from the rice fields in West Malaysia are presented. The egg and five nymphal instars are described and illustrated.

Egg development in the laboratory took approximately 3.0 days. The average time spent in each of the five nymphal stages was 2.8, 2.1, 1.4, 2.2, and 3.8 respectively.

DESCRIPTORS: Hemiptera, Anthocoridae, *Orius,* Malaysia, rice predator, predator, rice, immature, biology

During studies of entomophagous arthropods of rice fields in West Malaysia *Orius tantillus* was found to prey upon a variety of rice field insects. Ghauri (1972) found *O. tantillus* to be widely distributed having observed specimens from Ceylon, India, Queensland, and the Solomon Islands as well as other Pacific islands. During this study the species was collected throughout West Malaysia. Life history, behavior and ecology was investigated with the hope that such information would help in an evaluation of its potential as a biological control agent of rice pests. Studies were conducted from 1971 to 1973 at the Malaysian Agricultural Research and Development Institute, Rice Research Station at Bumbong Lima, West Malaysia.

Materials and Methods

Field collected adults were brought into the laboratory for studies of life history and biology. Specimens were reared at room temperature and humidity in glass cylinders approximately 50 mm long and 7 mm in diameter. Both ends of the tubes were plugged with cotton. The cotton on one end of the tube was wet with tap water twice daily. To obtain nymphs of a known instar they were examined daily to check molting.

Adults and nymphs were fed daily on first and second instar nymphs of *Nephotettix virescens* (Homoptera: Cicadellidae). Four

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to six leafhopper nymphs were placed in each container every morning.

Descriptions were based on living and freshly killed, as well as field collected and laboratory reared materials. Specimens were killed in 70% ethanol and mounted on microscope slides in glycerol. Averages and ranges given in the descriptions were based on 4 - 6 measurements. Length was measured from the tip of the tylus to the tip of the abdomen. The widest measurement represents the widest point which is approximately at the middle of the abdomen for instars 1 through 3 and across the mesothoracic wing pads for instars 4 and 5. The width of the head was measured between the outer ocular margins of the compound eye.

Biology

Orius tantillus appears to be widely distributed throughout West Malaysia, having been collected in various localities in Kedah, Province Wellesley, and Selangor. Under many field conditions the species appears to be present in low numbers but on occasion becomes very abundant. The low density of specimens observed in many rice field samples is perhaps due to its small size and its apparent preference for main stem portions of the rice plant, thereby making it difficult to collect with a sweep net. Specimens appear to be most readily collected on warm sunny days after the vegetation has dried. On one occasion 20 minutes collecting at 9:30 a.m. yielded only 2 specimens, but by 11:15 a.m., when the vegetation had dried, 30 specimens were collected in the same place in 10 minutes with a sweep net.

Under suitable conditions the species becomes very common and may represent one of the most abundant predators in a sample of rice field insects. In Selangor during 1971 *O. tantillus* were estimated to be present on the batas of a rice field at a density of approximately 16 adults per square meter. Highest densities were frequently observed in nurseries. In rice fields highest densities have been encountered during the early part of the growing season.

In the laboratory eggs were laid singly in rearing containers, usually with the posterior portion inserted in the cotton at one end of the container and the operculum about level with the sur-

face of the cotton. On occasion the eggs were laid on their sides or placed between the cotton and glass of the rearing container. In all observed cases the eggs laid on a given day were placed at the same end of the container, usually near each other but never touching.

Number of eggs laid per day ranged from 1 to 7 with an average of 1.56 eggs per day (Table I). The average was figured from 10 females over 104 laying days. The lowest number of eggs laid per day for an individual female was 0.6 over a period of 27 days; the highest was 2.5 eggs per day over a period of 13 days. Frequency of egg laying did not appear to follow any particular pattern. Some females laid 1 or 2 eggs every day for several days very regularly and then might miss a day or more or might lay 4 or 5 eggs in 1 day. Other specimens would lay more irregularly but tended to lay larger numbers of eggs on laying days. The longest recorded lapse in egg laying was 10 days and the longest continued laying period was 12 days. Field collected females laid eggs for a varying number of days before dying; the maximum being 27 days.

Eggs hatched in 3 days and no eggs were observed not to hatch. Nymphal development averaged 12.3 days. The entire development period averaged 15.3 days (Table II).

All stages are non-specific predators. In the laboratory specimens were observed to feed on various species of leafhoppers, lepidoptera eggs, thrips, aphids and early instar lepidoptera larvae including first instar stem borer larvae *(Tryporysa incertulas).* Observations indicated that thrips may be the preferred food of this species and make up a significant part of the natural diet.

Orius tantillus nymphs and adults approached potential prey with beak extended. Once contact was made the prey was killed rapidly, suggesting that a poison may be involved in the capture of prey. Leafhopper nymphs 2 to 3 times the size of the anthocorid put up very little fight after being bitten.

Nymphs and adults showed no particular shyness in attacking prey larger than themselves, particularly when they were starved.

In glass rearing containers adults would eat 2-5 leafhoppers of second instar *Nephotettix* per feeding, which usually lasted from 1 to 2 hours. The feeding time per leafhopper varied greatly, but 10

Table I. Egg Laying Histories

Female number	1	2	3	4	5	6	7	8	9	10	Average
Number of laying days	4	22	18	5	4	2	5	10	4	27	
Number of eggs laid	6	15	27	8	5	4	12	15	10	17	11.9
Average number of eggs laid per day	1.5	0.7	1.5	1.6	1.3	2.0	2.4	1.5	2.5	0.6	1.5
Range of eggs laid per day	1-3	1-3	1-4	1-3	1-2	2-0	1-5	1-7	1-6	1-5	

Table II. Development of Immature Stages of *Orius tantillus* in Days

Stage	Number of individuals	Range	Mean	Cumulative mean age
Egg	35	3.0	3.0	3.0
Nymphal				
First	16	2-3	2.8	5.8
Second	16	1-3	2.1	7.9
Third	15	1-2	1.4	9.3
Fourth	14	2-3	2.2	11.5
Fifth	14	3-4	3.8	15.3

to 20 minutes was normal. During that time the arthocorid often removed the beak and inserted it in a new place.

Interestingly it was observed that the absence or presence of leafhoppers in the area of the feeding bug appeared to determine the length of time the prey was fed upon as well as the number of leafhoppers killed in a given length of time. The larger the number of leafhoppers in the container the larger the number killed even though the total feeding time may have been about the same. This took place because *O. tantillus* appeared to be attracted by movement of prey near it. Not uncommonly *O. tantillus* would kill a leafhopper, feed on it for a short time, and then if another leafhopper moved nearby, the anthocorid would leave the insect it was feeding on and attack the living prey. This feeding behavior might be repeated several times, thereby obtaining a greater mortality of prey than necessary to support the predator. It appeared to be necessary for the leafhoppers to move to the predator since the anthocorid usually did not go searching for prey until it had finished feeding.

The habit of leaving a dead prey to attack another living prey may be considered a beneficial predator characteristic since it causes a higher mortality of the prey population. The role played by this factor on prey morality would depend on the mobility and density of the prey species. This type of behavior pattern may cause higher mortality in clumped populations than in evenly dispersed ones.

In cages the behavior usually resulted in several dead leafhoppers in the immediate area of the predator. The anthocorid would often move from one dead leafhopper to another during its feeding. In the field, however, this would not happen. Once the prey had been released it would fall to the ground and the predator would not be able to return. The predator would therefore be required to obtain a new prey.

Description

Egg (Fig. A)

Length 0.438 mm, width 0.186 mm, width at anterior end 0.106 mm.

Form ellipsoidal. Anterior end capped by a circular operculum surrounded by an expanded rim of chorion 0.106 mm in diameter. The basal one-half of the chorion

marked by a pattern of rectangles. The anterior portion of the chorion smooth. The operculum appears to be flat without any medial projection. When laid the egg is entirely white in color. The day following the eye spots appear red and entire egg becomes straw colored. On proceeding days the eye spots become deeper red and the egg a darker straw color until hatching takes place.

First Instar (Fig. B)

Length 0.50 – 0.57 mm ($\bar{x}$ = 0.55 mm), width 0.15 – 0.20 mm ($\bar{x}$ = 0.17 mm), width of head 0.14 – 0.15 mm ($\bar{x}$ = 0.15 mm), humeral width 0.15 – 0.16 mm ($\bar{x}$ = 0.15).

Form elongate, convex above and below. The body is uniformly straw colored slightly suffused with pale orange-red. The head is triangular, widest at eyes and concolorous with rest of body above and below. Eyes are deep brick red. Dorsal surface sparsely covered with short setae being most numerous on the tylus. Antenna 0.26 mm long, 4 segmented, ratio of length of segments approximately 1 : 2 : 2 : 4; pale smoky-gray in color, all segments concolorous, whitish annuli at joints; segment 4 diameter 2 times that of the 3 interior segments. Segment 1 glabrous, other segments about equally clothed with setae. Labrum 0.21 mm long, 3 segmented, ratio of length of segments approximately 1 : 3 : 3, concolorous with head except segment 3 which is smoky-gray in color, concolorous with antenna. All segments with a few scattered setae.

Thorax concolorous with head above and below. Thoracic nota are all transverse and wing pads are lacking. Femur and coxa concolorous with thorax. Tibia and tarsus pale smoky-gray with numerous setae. Spines at distal of tibia. Protibia with largest concentration of spines. All coxa widely and about equally separated, tarsi are 2-segmented, the first segment much shorter than the second.

The abdomen concolorous with thorax. Abdominal tergites 3, 4 and 5 with a median orangish-red spot. Tergites 8 and 9 each with 2 long setae, one on either side of middle near the lateral margins. Abdomen with 4 pairs of dorsal scent glands opening as follows: a pair between the third and fourth, fourth and fifth, and fifth and sixth segments with the openings of each pair jointed by a groove; a separated pair located between the sixth and seventh segments.

Second Instar (Fig. C)

Length 0.75 – 0.77 mm ($\bar{x}$ = 0.76 mm), width 0.24 – 0.30 mm ($\bar{x}$ = 0.27 mm), width of head 0.17 mm, humeral width 0.22 – 0.25 mm ($\bar{x}$ = 0.23 mm).

With the exception of size this instar appears to be essentially the same as the first instar. Antenna is 0.30 mm long, ratio of length of segments are approximately 1 : 2 : 2 : 4. Labrum 0.23 mm long, ratio of length of segments approximately 1 : 3 : 3.

Third Instar (Fig. D)

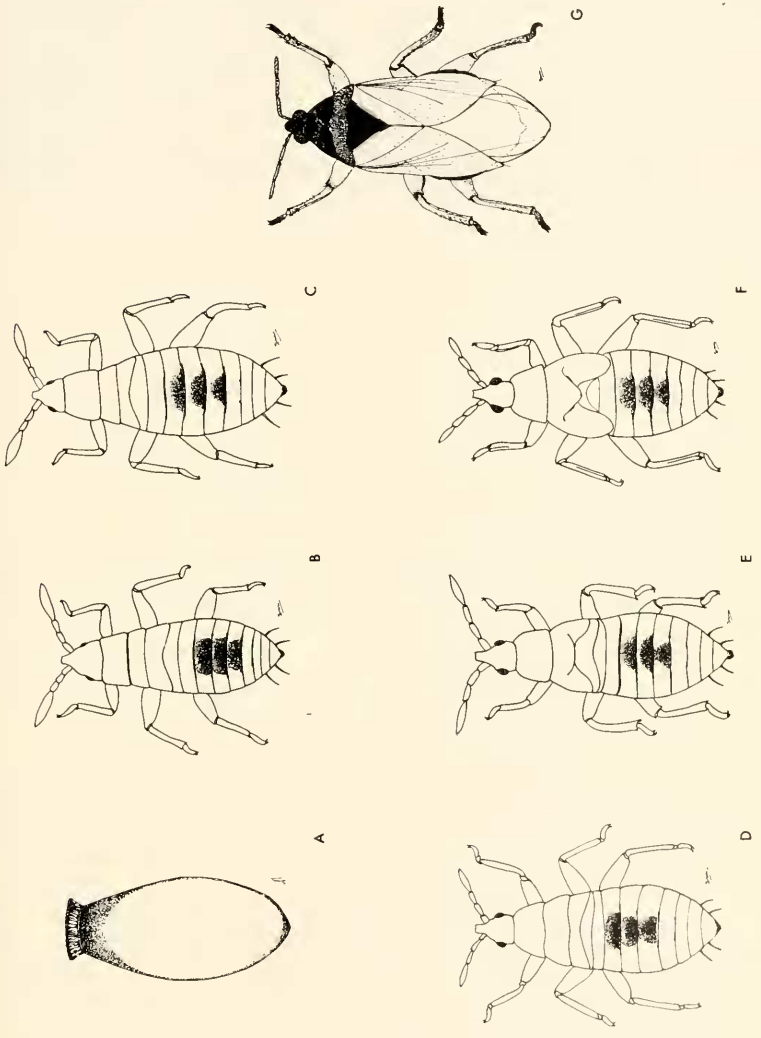
Length 0.87 – 1.0 mm ($\bar{x}$ = 0.96 mm), width 0.37 – 0.40 mm ($\bar{x}$ = 0.38 mm), width of head 0.23 mm, humeral width 0.27 mm.

Form and coloration of the body differs little from the first and second instars.

Meso and meta-thoracic wing pads are slightly visible, extending only slightly beyond median posterior margin. Meta-thoracic wing pads slightly more developed than meso-thoracic wing pads.

Antenna is 0.36 mm long, ratio of length of segments are approximately 2 : 3 : 3 : 4. Antenna different from earlier instars by having all segments of about equal diameter.

Labrum 0.25 mm long, ratio of length of segments approximately 1 : 4 : 3. Third segment more blackish in color.



Figs. A – G. *Orius tantillus.* A, lateral view of egg; B, first instar; C, second instar: D, third instar; E, fourth instar; F, fifth instar; G, adult.